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Nogle

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[54] **LINEAR TRANSLATION OF PRNDL**

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[51] **Int. Cl.**[7] **B60K 20/04**

[52] **U.S. Cl.** **74/473.11**; 74/337.5; 74/473

[58] **Field of Search** 74/473.11, 337.5, 74/473.28; 137/637.1; 200/61.91; 340/456, 686

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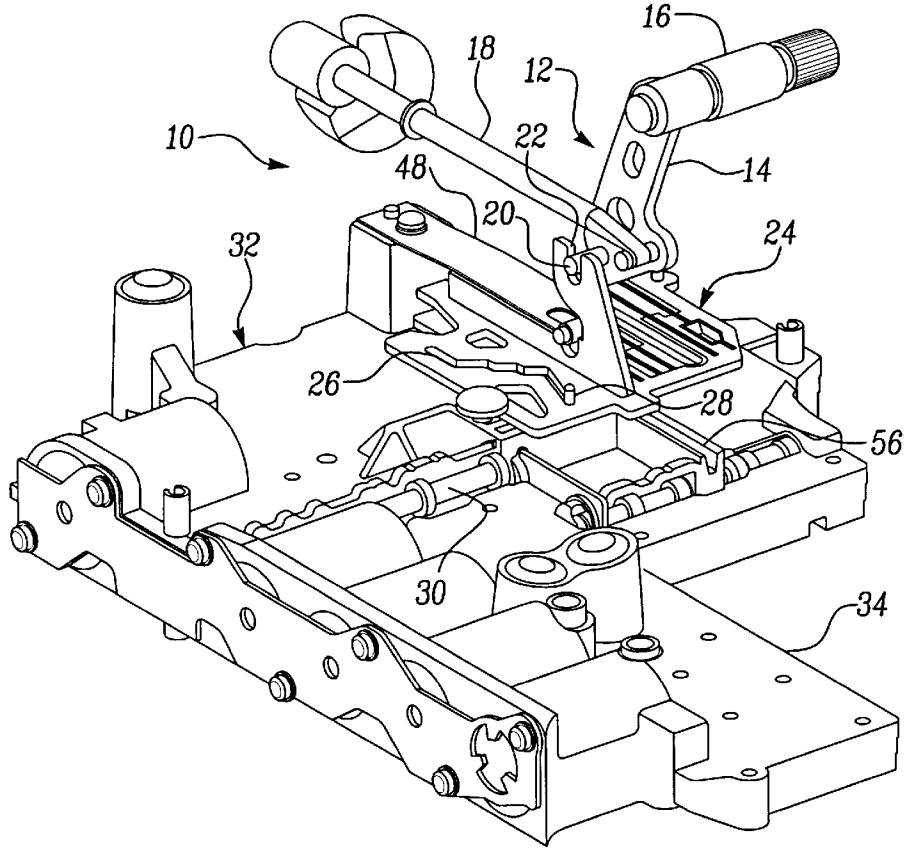
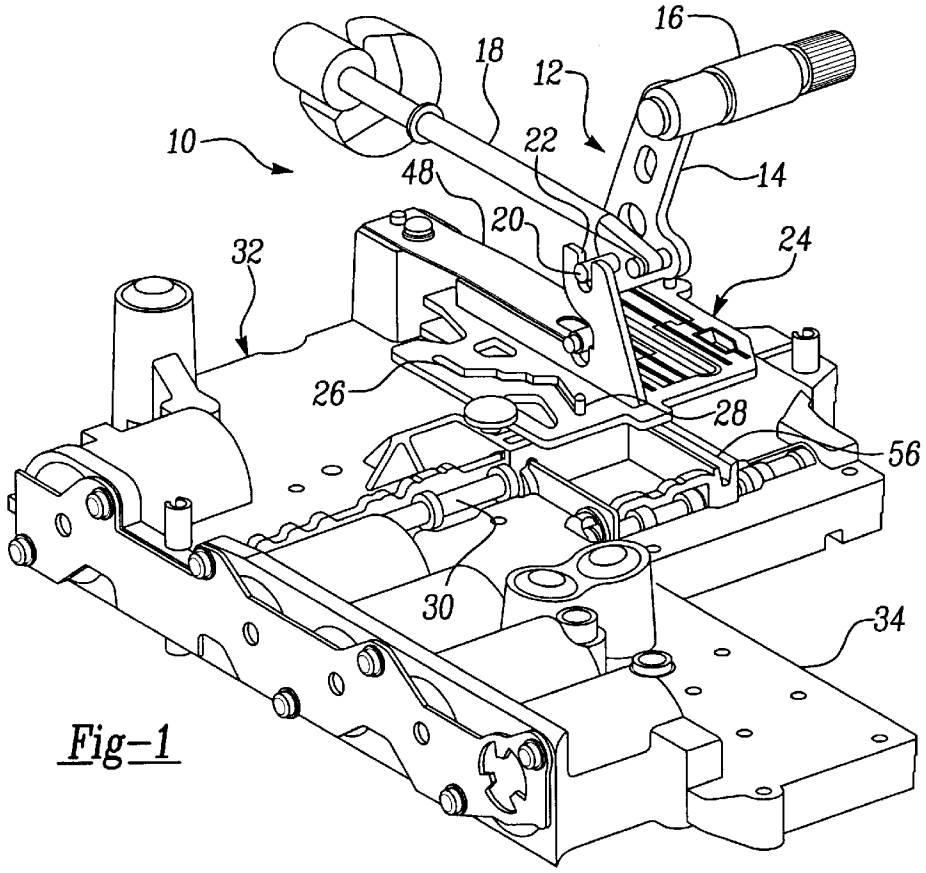
[57] **ABSTRACT**

A valve assembly having an advantageous construction for directing fluid flow between a fluid source and a fluid actuating device in a transmission of a vehicle. The valve assembly includes a manual lever being actuated in response to a manual input from an operator. The manual lever is positionable in a plurality of positions corresponding to predetermined operating modes of the transmission. The assembly further includes a valve body having valve member disposed therein. The valve member being movable for directing fluid flow between the fluid source and the fluid actuating device. A plate member slidably engaging the valve body is further provided. The plate member is operably coupled to the manual lever to linearly translate the plate member relative to the valve body in response to the manual input. Cam member is included for positioning the valve member at a predetermined position corresponding to the plurality of positions of the manual lever when the plate member is linearly translated.

17 Claims, 2 Drawing Sheets

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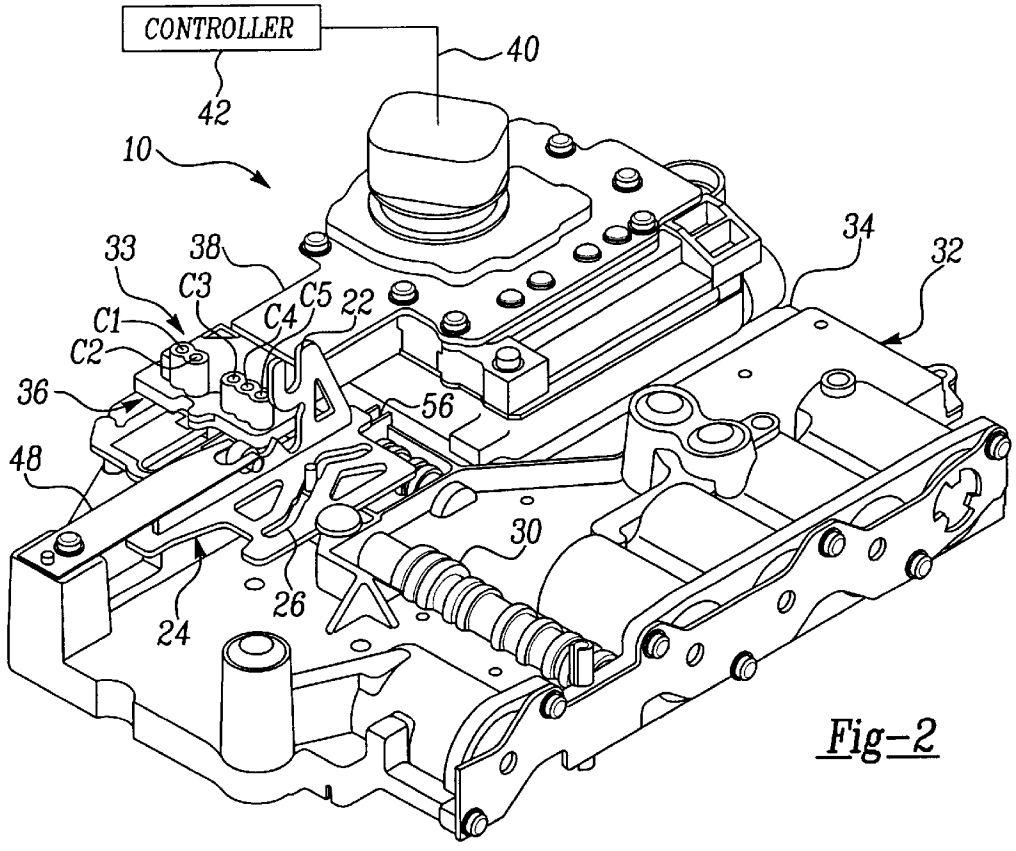
Fig–1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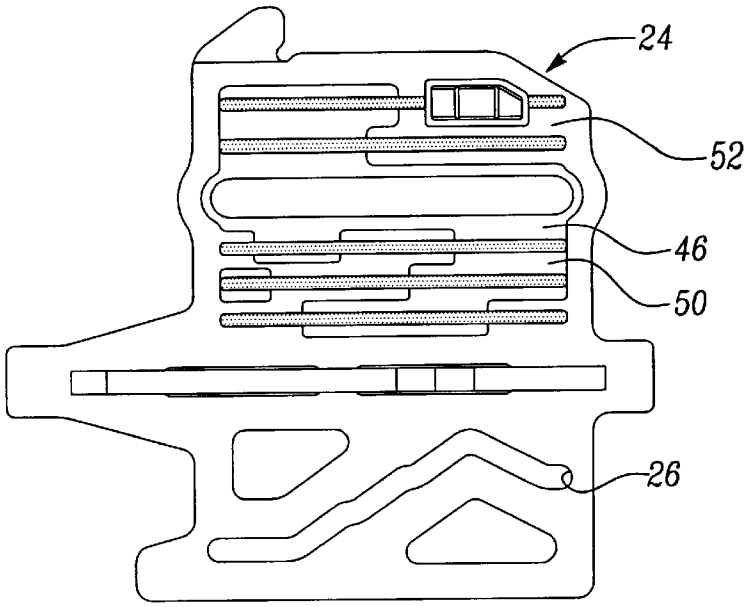
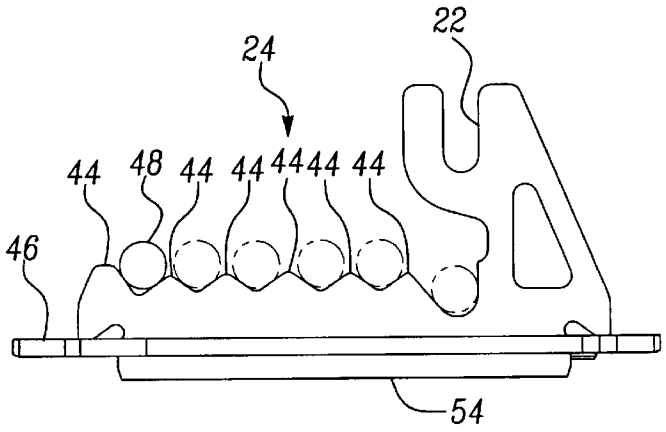
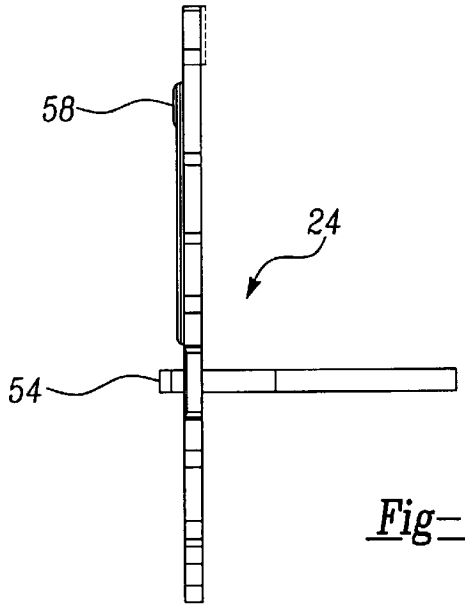
Fig–2

Fig–3





Fig–4



Fig–5

LINEAR TRANSLATION OF PRNDL

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is related to the following co-pending applications, which are incorporated herein by reference:

U.S. Ser. No. 09/282,375 for an invention entitled "PRNDL CODE USING 5 PINS"; and

U.S. Ser. No. 09/282,987 for an invention entitled "CAMMING MANUAL LEVER FOR PULL-OUT LOAD."

FIELD OF THE INVENTION

The present invention relates to an automatic transmission for a vehicle and, more particularly, to a coding plate capable of being linearly translated for actuating a manual valve in an automatic transmission.

BACKGROUND OF THE INVENTION

As is well known to those skilled in the art, many automatic transmissions include manual valve assemblies capable of directing fluid flow between a fluid source and a fluid-actuating device in the transmission.

Currently, there exists an automatic transmission system having a cam controlled manual valve assembly. A thorough discussion of such a cam controlled manual valve assembly is contained in U.S. Pat. No. 4,916,961 ('961) issued on Apr. 17, 1990, to Holbrook et al. and entitled "Cam-Controlled Manual Valve In An Automatic Transmission," which is commonly owned by the assignee of the present application. This patent is hereby incorporated by reference.

With reference to FIG. **4***b* of the '961 patent, the manually actuated valve assembly includes a manual lever having a cam groove formed thereon for actuating the manual valve of the transmission. The manual lever is rotated in response to a manual input from the operator. A valve pin connected to the manual valve is disposed in camming relationship with the cam groove of the manual lever such that when the manual lever is rotated, the pin travels within the cam groove to move the manual valve to a predetermined operating mode position (PRNODDL). However, it should be appreciated that the rotational movement of the manual lever relative to the valve pin may not afford maximum protection against bind. Furthermore, the curvature of the cam groove increases the difficulty of maintaining manufacturing tolerances in the manual lever.

Recently, attempts have been made to incorporate the electronic sensing system with the manual lever. A thorough discussion of such a transmission sensing system is contained in U.S. Pat. No. 5,325,083 ('083) issued on Jun. 28, 1994 to Nassar et al. and entitled "Manual Valve Position Sensing System," which is commonly owned by the assignee of the present application. This patent is hereby incorporated by reference.

With reference to FIGS. **3** and **6** of the '083 patent, the sensing system includes a plate member that rotates in response to the shift lever and includes a cam surface at the edge with electrically conductive and non-conductive areas. An electrical sensor unit is mounted in the transmission in a position to communicate with the contact surface of the plate member. Four electrical contact pins engage the conductive and non-conductive areas on the plate member and generate a binary code having combinations thereof that represent each of the shift lever positions and transition areas. However, like the '961 patent, the technique employed in the '083 patent may not afford maximum protection against bind in the cam when the plate member rotates relative to the valve pin. Moreover, the curvature of the cam groove increases the difficulty of maintaining manufacturing tolerances in the plate member. Still further, it may be difficult to maintain manufacturing tolerances in the electrically conductive and non-conductive areas, relative to the cam groove. Variations in the placement of the conductive and non-conductive areas relative to the cam groove may lead to the transmission controller incorrectly detecting the position of the manual valve.

Accordingly, there exists a need in the relevant art to provide a valve assembly capable of accurately positioning the manual valve that overcomes the disadvantages of the prior art. Furthermore, there exists a need in the relevant art to provide a valve assembly capable of minimizing bind in the cam groove caused from rotational motion. Still further, there exists a need in the relevant art to provide a valve assembly capable of providing a plate member having conductive and non-conductive areas formed accurately relative to a cam groove to insure improved position detection by a transmission controller.

SUMMARY OF THE INVENTION

In accordance with the broad teachings of this invention, a valve assembly having an advantageous construction for directing fluid flow between a fluid source and a fluid actuating device in a transmission of a vehicle is provided. The valve assembly includes a manual lever being actuated in response to a manual input from an operator. The manual lever is positionable in a plurality of positions corresponding to predetermined operating modes of the transmission. The assembly further includes a valve body having valve means disposed therein. The valve means being movable for directing fluid flow between the fluid source and the fluid actuating device. A plate member slidably engaging the valve body is further provided. The plate member is operably coupled to the manual lever to enable the plate member to linearly translate relative to the valve body in response to the manual input. Cam means is provided for positioning the valve means at a predetermined position corresponding to the plurality of positions of the manual lever when the plate member is linearly translated.

Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are intended for purposes of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. **1** is a perspective view of a valve assembly for an automatic transmission having a sensing unit removed for clarity according to the teachings of the present invention;

FIG. **2** is a perspective view of the valve assembly showing the sensing unit and having the manual lever removed for clarity;

FIG. **3** is a plan view of the linearly translated plate member;

FIG. 4 is a side view of the linearly translated plate member; and

FIG. 5 is an end view of the linearly translated plate member.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description of the preferred embodiment is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

Referring to FIGS. **1** and **2**, valve body assembly **10** is shown therein for directing fluid flow between a fluid source (not shown) and multiple fluid-actuating devices (not shown) in a transmission of a vehicle. Valve body assembly **10** includes a manual lever assembly **12** having a manual lever **14** connected to a shaft member **16**. Shaft member **16** is generally mounted within a support structure (not shown) having an opening that allows for a rotational movement of manual lever **14**. Manual lever assembly **12** is attached to a shift rod (not shown) that is moveable by an operator of a vehicle to select one of a plurality of transmission operating modes, such as park, reverse, neutral, drive, second, and low (PRND2L). FIG. **1** also shows that a park pawl rod **18** is connected to manual lever **14** to permit actuation of park pawl rod **18** by manual lever assembly **12**.

Manual lever **14** rotates in response to operator input amongst positions that generally represent operating modes for an electronically controlled automatic transmission. In doing so, manual lever **14** has a pin **20** formed on an end thereof as shown in FIG. **1**, which engages a pin slot **22**. Pin slot **22** is formed within a coding plate **24**. Coding plate **24** has a cam surface composed of a slot or cam groove **26** formed therein as shown in FIGS. **1–3** that engages a valve pin **28**. Valve pin **28** is connected to a manually operated valve **30** for controlling the hydraulic fluid flow throughout a valve assembly **32** in an automatic transmission. As such, the rotation of manual lever **14** causes pin **20** to engage pin slot **22** so as to linearly translate coding plate **24** to predetermined positions, which in turn controls the hydraulic system of the transmission.

A sensing unit **33** is mounted above a portion of coding plate **24** for sensing the position of coding plate **24**. Sensing unit **33** is fastened to a valve body **34** in a known manner. A channel **36** is provided between sensing unit **33** and valve body **34** as shown in FIGS. **1** and **2**, which allows coding plate **24** to slide linearly relative to sensing unit **33**.

Sensing unit **33** includes five spring loaded electrical contact pins C**1** through C**5** that extend therefrom and contact conductive and non-conductive areas on a contact surface on coding plate **24**. In this regard, it should be understood that the electrical contact pins C**1** through C**5** extend in a generally perpendicular relationship to the plane of coding plate **24**. Sensing unit **33** still further includes a support member **38** that supports and stabilizes sensing unit **33** and provides substantially uniform contact between each of the electrical contacts C**1** through C**5** and coding plate **24**. Sensing unit **33** further includes an electrical connection member **40** that is connected to a transmission controller **42**.

Referring to FIGS. **3–5**, Coding plate **24** has cam groove **26** routed therethrough to provide a cam surface for receiving the manually operated valve pin **28**. As such, linear translation of coding plate **24** causes valve pin **28** to move manually operated valve **30** back and forth in accordance with predetermined valve settings. Coding plate **24** further includes raised notches **44** formed perpendicular to contact surface **46** for engaging a detent spring **48**. As coding plate **24** is linearly translated, detent spring **48** engages operating notches **44** for each of the operating modes (PRND2L).

Contact surface **46** of coding plate **24** includes non-conductive areas **50** and conductive areas **52** formed thereon in a predetermined design to cooperate with contacts C**1** through C**5** in creating the desired binary code. As can be appreciated, non-conductive areas **50** and conductive areas **52** are orientated in a simple X-Y coordinate system to facilitate simple and convenient manufacture thereof. Therefore, improvements in manufacturing accuracy may be realized due to the specified design of the present invention relative to previous arcuate design patterns. Coding plate **24** further includes a guide rib **54** formed on the underside of coding plate **24**. Guide rib **54** engages a guide channel **56** formed in valve body **34** to ensure proper linear translation of coding plate **24**. Still further, coding plate **24** maintains an electrical ground contact with valve body **34**, generally at reference **58**, as the underside of coding plate **24** is retained in sliding engagement with valve body **34** by sensing unit **33** and detent spring **48**. Preferably, coding plate **24** is made of a simple steel (or other metal) stamping that is locally overmolded with a non-conductive plastic, such as nylon.

As coding plate **24** is moved between the plurality of operating modes, non-conductive areas **50** and conductive areas **52** travel across the electrical contacts C**1** through C**5**. In doing so, sensing unit **33** senses either conductive or non-conductive contact for each of the electrical contacts C**1** through C**5**. Electrical contact with conductive area **52** grounds the electrical contact and thereby generates a binary "0". In contrast, electrical contact with non-conductive area **50** generates a binary code "1".

The binary codes generated by each of the electrical contacts C**1** through C**5** are then provided to transmission controller **42**. Transmission controller **42** preferably compares the binary codes with predetermined combinations of binary codes to determine the position of manual lever assembly **12**.

In operation, manual input to valve body assembly **10** actuates and determines the position of coding plate **24**. A vehicle operator manually moves manual lever **14** via a shift linkage mechanism to select one of a plurality of operating modes (PRND2L). In doing so, manual lever **14** rotates in a plane generally perpendicular to the plane of coding plate **24**. Rotation of manual lever **14** causes pin **20** to cam within pin slot **22** of coding plate **24**. Specifically, pin **20** of manual lever **14** exerts a force upon pin slot **22** generally parallel to guide channel **56**. This force on pin slot **22** causes coding plate **24** to linearly translate along valve body **34** so that electrical contacts C**1** through C**5** contact non-conductive areas **50** and conductive areas **52** to generate the combinations of binary codes that represent the position of coding plate **24**. The combinations of binary codes provide for operating codes that are separated by transition codes. The binary coded combinations are then provided to transmission controller **42**. Transmission controller **42** may thereby compare the binary codes with predetermined combinations of codes to determine the position of coding plate **24** and ensure proper operation of the transmission.

It should be appreciated that the present invention provides a coding plate that is simple to accurately manufacture. Furthermore, the present invention provides a reliable and accurate method of actuating the manual valve; while, simultaneously, provides a reliable and accurate method of sensing the position of the coding plate. The linear translation of the coding plate provides an improved camming action to minimize bind between the valve pin and the cam

groove. Still further, by forming the cam groove, the detent notches, and the conductive and non-conductive areas relative to each other on a single, linearly-translated member, the mechanical, electrical, and hydraulic events are accurately related and the controller can more accurately detect the operating mode selected and the actual position of the manual valve.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention. Such variations or modifications, as would be obvious to one skilled in the art, are intended to be included within the scope of the following claims.

What is claimed is:

1. A valve assembly for directing fluid flow between a fluid source and a fluid actuating device in a transmission of a vehicle, said assembly comprising:

a first member being actuated in response to a manual input, said first member being positionable in a plurality of positions corresponding to predetermined operating modes of the transmission;

a valve body having valve means for directing fluid flow between the fluid source and the fluid actuating device;

a linearly translated member being operably coupled to said first member to linearly translate said linearly translated member relative to said valve body;

cam means for positioning said valve means at a predetermined position corresponding to said plurality of positions of said first member when said linearly translated member is linearly translated.

2. The assembly according to claim **1** wherein said cam means comprises:

a cam slot formed in said linearly translated member; and

a pin member interconnecting said valve means and said linearly translated member and being movable in said cam slot.

3. The assembly according to claim **2** wherein said cam slot defines a park position, a reverse position, a neutral position, a drive position, a second gear position, and a first gear position for a park, a reverse, a neutral, a drive, a second gear, and a low operating mode of the transmission, respectively.

4. The assembly according to claim **1**, further comprising:

a guide slot formed on said valve body; and

a guide rib formed on said linearly translated member, said guide rib being adjacent said valve body such that said guide rib slideably engages said guide slot of said valve body to enable aligned linear translation of said linearly translated member relative to said valve body.

5. The assembly according to claim **1**, further comprising:

a detent spring mounted on said valve body;

a plurality of detent notches formed on said linearly translated member corresponding to said predetermined operating modes, said detent spring engaging said plurality of detent notches.

6. The assembly according to claim **1**, further comprising:

a drive slot formed on said linearly translated member; and

a drive pin formed on said first member, said drive pin engaging said drive slot formed on said linearly translated member,

whereby actuation of said first member in response to said manual input causes said drive pin to cam within said drive slot of said linearly translated member, thereby linearly translating said linearly translated member relative to said valve body.

7. A valve assembly for directing fluid flow between a fluid source and a fluid actuating device in a transmission of a vehicle, said assembly comprising:

a manual lever being actuated in response to a manual input, said manual lever being positionable in a plurality of positions corresponding to predetermined operating modes of the transmission;

a valve body;

valve means disposed in said valve body and being movable therein for directing fluid flow between the fluid source and the fluid actuating device;

a plate member slidably engaging said valve body, said plate member being operably coupled to said manual lever to linearly translate said plate member relative to said valve body;

a pin member interconnecting said plate member and said valve means; and

cam means for positioning said valve means at a predetermined position corresponding to said plurality of positions of said manual lever when said plate member is linearly translated.

8. The assembly according to claim **7** wherein said cam means comprises a cam slot formed in said plate member, said pin member being disposed and movable in said cam slot.

9. The assembly according to claim **8** wherein said cam slot defines a park position, a reverse position, a neutral position, a drive position, a second gear position, and a first gear position for a park, a reverse, a neutral, a drive, a second gear, and a low operating mode of the transmission, respectively.

10. The assembly according to claim **7**, further comprising:

a guide slot formed on said valve body; and

a guide rib formed on said plate member, said guide rib being adjacent said valve body such that said guide rib slideably engages said guide slot of said valve body to enable aligned linear translation of said plate member relative to said valve body.

11. The assembly according to claim **7**, further comprising:

a detent spring mounted on said valve body;

a plurality of detent notches formed on said plate member corresponding to said predetermined operating modes, said detent spring engaging said plurality of detent notches.

12. The assembly according to claim **7**, further comprising:

a drive slot formed on said plate member; and

a drive pin formed on said manual lever, said drive pin engaging said drive slot formed on said plate member,

whereby actuation of said manual lever in response to said manual input causes said drive pin to cam within said drive slot of said plate member, thereby linearly translating said plate member relative to said valve body.

13. A valve assembly for directing fluid flow between a fluid source and a fluid actuating device in a transmission of a vehicle, said assembly comprising:

a manual lever being actuated in response to a manual input, said manual lever being positionable in a plurality of positions corresponding to predetermined operating modes of the transmission;

a valve body having valve means disposed within said valve body, said valve means being movable within

said valve body for directing fluid flow between the fluid source and the fluid actuating device, said valve body further having a guide slot formed thereon;

a plate member having a guide rib formed thereon, said plate member being operably coupled to said manual lever, said guide rib of said plate member being adjacent said valve body such that said guide rib slideably engages said guide slot of said valve body to enable aligned linear translation of said plate member relative to said valve body;

a pin member interconnecting said plate member and said valve means; and

cam means for positioning said valve means at a predetermined position corresponding to said plurality of positions of said manual lever when said plate member is linearly translated.

14. The assembly according to claim **13** wherein said cam means comprises an irregular cam slot formed in said plate member, said pin member being disposed and movable in said cam slot.

15. The assembly according to claim **14** wherein said cam slot defines a park position, a reverse position, a neutral position, a drive position, a second gear position, and a first gear position for a park, a reverse, a neutral, a drive, a second gear, and a low operating mode of the transmission, respectively.

16. The assembly according to claim **13**, further comprising:

a detent spring mounted on said valve body;

a plurality of detent notches formed on said plate member corresponding to said predetermined operating modes, said detent spring engaging said plurality of detent notches.

17. The assembly according to claim **13**, further comprising:

a drive slot formed on said plate member; and

a drive pin formed on said manual lever, said drive pin engaging said drive slot formed on said plate member,

whereby actuation of said manual lever in response to said manual input causes said drive pin to cam within said drive slot of said plate member, thereby linearly translating said plate member relative to said valve body.

* * * * *